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Specification and Drawings, as originally filed, with Application for Patent Serial No:
2,317,319, on August 30, 2000, by **THE LITEBOOK COMPANY LTD.**, assignee of
Larry Verne Pederson, Clayton G. Coffey and Henry Hudema, for "Light Therapy Device".

Gracy Bushue
Agent certificateur/Certifying Officer

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ABSTRACT OF THE INVENTION

A light therapy device is taught including a light emitting assembly having light emitting diodes (LEDs) as a light source. The light emitting assembly capable of
5 generating 2,500 lux to 7,500 lux at 12 inches.

LIGHT THERAPY DEVICE

FIELD OF THE INVENTION

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The present invention relates to a light therapy device and in particular to a light therapy device for treatment of light deficient disorders.

BACKGROUND OF THE INVENTION

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There is much support for the use of light therapy to overcome light deficient disorders. It has been proven that treatments involving shining light directly towards a patient's eyes will alleviate or cure light deficient disorders including Seasonal Affective Disorder (SAD), circadian sleep disorders and circadian disruptions associated with jet-lag, shift-work, PMS and bulimia.

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There are two types of light therapy devices presently available. One type of device is large in size and floor or desk mountable. These devices include light sources of fluorescent bulbs. Although they can be moved from one position to another, they are not generally portable. In addition, the light source is quite fragile. The second kind of light therapy devices are head mountable. These devices are formed as eye glasses or visors. While they are portable, they are not generally accepted by patients for use in public because of their odd appearance when worn on the head. This combined with safety concerns about eye damage given the proximity of the light source to the eye, has resulted in head mountable treatment devices failing to be generally accepted as a light therapy device.

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These devices therefore are of limited use for persons requiring a portable and discreet treatment device. A light therapy device is needed for use by, for example, the business traveler that is portable and aesthetically appealing.

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SUMMARY OF THE INVENTION

The present invention provides a portable and light-weight hand-held light therapy device. The device is durable, being resistant to damage by normal transport. The device uses light emitting diodes (LEDs) as a source of light. LEDs offer a light source that is light-weight, small in size, simple, durable as well as energy efficient. The device is useful for travel and for in-flight use while being aesthetically acceptable.

10 In accordance with one aspect of the present invention, there is provided a light treatment comprising: an outer housing including a opening; a light emitting assembly in the housing and operable to emit light through the opening in the housing, the light emitting assembly including a plurality of LEDs capable of generating 2,500 lux to 7,500 lux at 12 inches.

15 The LEDs include at least some capable of emitting white-light. In one embodiment, the LEDs are arranged in a pattern over an area and the light emitting assembly is selected to emit light from the LEDs along a substantially straight line directly toward the user. Preferably, a diffuser screen of light diffusing sheet material is positioned over the LEDs to provide a more uniform emission of light. While LEDs do not emit any significant amount of ultraviolet radiation, the diffuser sheet material can include a UV filter, if desired.

20 To facilitate therapy using the device, the housing can also accommodate a therapy calculator for determining a treatment regime based on an input of information.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front elevation view of a light therapy device according to the present invention. A portion of the device has been cut away to facilitate illustration of internal components.

Figure 2 is a side elevation view of the light therapy device of Figure 1 with the support leg folded against the housing.

Figure 3 is a sectional view along line A-A of Figure 1.

5 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figures 1 to 3, a light therapy device according to one embodiment of the present invention is shown. The device is small in size and resembles a large calculator or hand-held computer. Preferably, the outside dimensions of the device
10 are less than about 7 inches wide, 7 inches high and 1.5 inches deep. The size can be varied as desired and with consideration as to portability, convenience and the components that must be contained therein.

The device includes an outer housing 10. The housing is preferably formed of a durable, impact resistant material such as, for example, a polymer (i.e. nylon, thermoplastic or blends thereof). Preferably, all housing parts are of minimal thickness to provide suitable impact resistance and support for internal components while minimizing the weight of the device. The housing can be formed, as shown, in parts secured together by screws 12 or other fastening means.
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20 The housing carries a light emitting assembly 20. The light emitting assembly is mounted in the housing such that in operation light emitted therefrom is directed out through an opening 22 in the housing.

25 Light emitting assembly 20 includes a printed circuit (PC) board 26 providing electrical connection for light emitting diodes 28. The LEDs are spaced apart on the board, with consideration as to their light output and wavelength, such that the assembly emits a light of illumination adequate for treatment of light deficient disorders. In particular, the light emitting assembly generates adequate illumination
30 for treatment of light deficient disorders including Seasonal Affective Disorder (SAD), circadian sleep disorders and circadian disruptions associated with jet-lag, shift-work, PMS and bulimia, which is between 2,500 and 7,500 lux, and preferably

between about 3,500 and 5,500 lux at 12 inches from the assembly. To generate this level of illumination, the assembly generally includes between about 10 and 150 LEDs together having a total light output of between 50 and 500 candelas and preferably about 250 to 450 candelas. The number of LEDs in the light emitting
5 assembly may be reduced considerably as the efficiency of a LED is increased.

For bright-light therapy, preferably white LEDs are used. However, it is sometimes useful to combine light of different wavelengths and in some instances to approximate the spectral properties or distribution of a tropical sunrise. Therefore, LEDs 28 can be
10 entirely of the type emitting white light or, alternatively, LEDs emitting light of various wavelengths (i.e. red or amber) can be used with white light emitting diodes. The light generated by the light emitting assembly is preferably constant, though it may also be pulsed.

15 In one embodiment, a diffuser screen 32 is mounted over the diodes to create a more uniform, less harsh light emission. Preferably, LEDs 28 are mounted a suitable distance from diffuser screen 32 such that the light emitted by each LED overlaps on the screen and avoids the appearance of individual points of light behind the screen. If a diffuser screen is used, it is necessary to ensure that adequate levels of light, as set
20 out above, are passed therethrough to permit treatment.

Power is supplied to the LEDs through electrical lines 34. Power can be provided through batteries or preferably, to reduce weight, through a jack 36 for connection to a 120v electrical supply (for use in North America). The device preferably operates
25 using DC power and is supplied with an external AC-DC converter. Since the device is particularly useful during long distance travel in the treatment of jet-lag, an adapter can be provided within the device or separately for device compatibility with foreign voltages of AC power or with DC power, as is provided through power ports mounted in aircraft armrests.

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To facilitate light treatment, a support leg 40 can be provided for supporting the housing in a propped position such that light is emitted in a generally horizontal

direction. In one embodiment, support leg 40 is connected by a hinge 42 to the rear of the housing such that the leg can be rotated to between a supporting position and a stored position against the rear of the housing.

- 5 Housing 10 can also be formed to accommodate other electronics, batteries etc. or to define storage space such as for cords, adapters, glasses or other items. The housing can also include a cover, a case and/or a more complex stand for elevating the light illuminating assembly.
- 10 Using a light therapy device according to the present invention, treatments of acceptable duration can be administered. As an example, treatments for SAD can be completed in ¼ to 4 hours and in most cases, ½ to 3 hours.

In one embodiment, housing 10 also accommodates a calculator including a display
15 82, a key pad 84 and a processor mounted within housing 10. The calculator is programmed to calculate a light treatment regime based on input of information. The calculator processor uses calculation references such as that known as the Jet Lag Calculator™ available from Bio-Brite, Inc., Maryland. In one embodiment, the calculator calculates light treatment regimes for jet lag based on inputs of information,
20 as follows:

Option 1

- i. Number of time zones crossed during trip
- ii. Direction of time zones crossed (East or West)
- 25 iii. Normal wake-up time of patient (for establishing the patient's "body clock")

Option 2

- i. Departure city
- 30 ii. Arrival city
- iii. Normal wake-up time of patient

Based on the input of the above-noted information, the calculator will then calculate and display a treatment regime including, for example, a period of light exposure and a period of light avoidance. In option 2, the calculator determines the number of time zones through which travel will occur and uses this to calculate treatment regime.

- 5 The calculator in one embodiment calculates a two-day treatment regime.

In one embodiment, the calculator keypad includes keys to be depressed when inputting particular information. As an example, the keypad can include keys such as: "departure city", "destination city" and "wake up time". The calculator can be
10 adapted to prompt the patient such as by displaying questions requesting the appropriate information. Preferably, the calculator includes a pause function capable of recording a time of treatment interruption and capable of outputting from memory the portion of the treatment remaining when treatment is resumed.

- 15 In addition or alternately, calculator can be programmed for calculation of other treatment regimes such as, for example, for treatments to alleviate fatigue in shift workers. Treatments for shift workers may include inputs such as work shift start time, previous shift time and normal waking time.

- 20 A speaker 88 is preferably provided for communication to the user. As an example, the speaker can communicate with the calculator processor to audibly prompt a user to input information. In addition, the speaker can function to emit an audible signal, such as an alarm, to alert a user to commence or modify a treatment. In one embodiment, the calculator processor controls a switch for the light emitting assembly
25 such that it is turned on or off in response to a signal from the processor.

In a preferred embodiment, the calculator memory is capable of storing previous treatment regimes. These stored treatment regimes can be recalled from processor memory for repeat trips or shift work schedules.

If desired, to enhance the usefulness of the device, the calculator can also be programmed with other information including a clock, a standard mathematical calculator or other information such as an address book, etc.

- 5 Numerous modifications, variations and adaptations may be made to the particular embodiments of the invention described above without departing from the scope of the invention as defined in the claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

- 5 1. A light therapy device comprising:
 an outer housing including a opening;
 a light emitting assembly in the housing and operable to emit light through the
 opening in the housing, the light emitting assembly including a plurality of LEDs
 capable of generating 2,500 lux to 7,500 lux at 12 inches.
- 10 2. The light therapy device of claim 1 wherein at least some of the LEDs are
 capable of emitting white-light.
3. The light therapy device of claim 1 wherein a diffuser screen of light diffusing
15 sheet material is positioned over the LEDs.
4. The light therapy device of claim 1 wherein the housing accommodates a
 therapy calculator for determining a treatment regime based on an input of
 information.

